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ABSTRACT

The relationship between expectancy and performance in a self-paced computer-assisted instruction (CAI) program is explored in this study. The hypotheses developed were that the subjects with high expectancy would perform better and require less instruction, set higher performance criteria for themselves, and have higher expectancy on a transfer task than subjects with low expectancies. The results of the experiment rejected all three hypotheses; the author suspected that dissonance feedback was the cause. Further investigation, however, revealed that the dissonance was not related to a significant difference in performance changes in the same subject. The author concluded that the study demonstrated that dissonance is more likely to lead to changes in expectancies than to changes in performance. (MC)

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THE RELATIONSHIPS BETWEEN EXPECTANCY AND PERFORMANCE IN A COMPUTER-ASSISTED INSTRUCTIONAL TASK

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THE RELATIONSHIPS BETWEEN EXPECTANCY AND PERFORMANCE IN A COMPUTER-ASSISTED INSTRUCTIONAL TASK

Introduction

Since even such sophisticated learners as college students differ greatly in the abilities they bring to bear on any instructional program, computer-assisted instructional programs often are designed so as to minimize individual differences which attenuate the efficacy of instructional programs. These programs often permit the learner to control his own learning to a greater extent than is possible with textbooks and lectures by permitting him to control the pace at which he learns and the amount of instructional material presented.

Even when such procedures are employed, there is considerable variance in performance. Certainly, many of the same differences in abilities which affect teacher-controlled learning also affect learner-controlled learning. Learner control and performance on computer-assisted instructional programs also might be affected by such motivational variables as expectancies.

The purpose of this study is to explore the relationship between expectancy and performance in a computer-assisted instructional task in which the learner controls the pace at which he works and the amount of instructional material to which he is introduced. Performance expectancy is considered in this study as a motivational variable which affects the learner's strategies for learning and consequently his performance. Cognitive consistency theory provides the theoretical framework for the development of experimental hypotheses and interpretation of results.

Aronson (1960) has provided the following explanations as to how the confirmation or disconfirmation of expectancies might affect achievement. If a person expects to perform well and does perform well, he is pleased with the consistency of his cognition and his behavior and does not experience dissonance. If a person expects to perform poorly and in fact performs poorly, he may be displeased with his performance, but his expectancy has been reinforced, and he does not experience dissonance. However, if a person expects to perform well and does not perform well, or if he expects to perform poorly and does well, he tends to experience dissonance. Aronson and Carlsmith (1962, 1963) maintain that in either case a person needs to resolve the inconsistency between his expectancies and performance in order to alleviate a negative affective state caused by the dissonance.

Expectancy as a Determinant of Performance

Aronson and Carlsmith (1962) developed a design for testing the effects of performance expectancy as a determinant of actual performance. Two experimental treatments were used: manipulation of expectancy and manipulation of performance, so that the subject's performance was either consistent or inconsistent with his performance expectancy.

The subjects were presented 100 cards, each of which contained three photographs. They were falsely informed that one of the persons on each card was schizophrenic and that the ability to distinguish these persons had been shown to be highly related to social sensitivity.

The task was composed of five sections, with 20 responses in each section. False prearranged scores were reported to two groups of subjects during the first four sections in order to facilitate the establishment of high expectancies in one group and low expectancies in the other group. The high expectancy group received scores of 5, 4, 4, 5 of the 20 points possible on the first four sections while the low expectancy group received scores of 17, 16, 16, 17 on the first four sections. On the fifth section the trend of the reported scores was reversed for half of the subjects in each of the two groups and the trend was maintained for the others. This created four experimental groups: high expectancy confirmed, high expectancy disconfirmed, low expectancy confirmed, and low expectancy disconfirmed.

The subjects then were told that the experimenter had failed to time the last section of the task, and they were asked to begin the fifth section of the task anew, as if they were seeing the materials for the first time. The authors reasoned that the number of responses changed between the first and second performances on the fifth section was indicative of the subject's satisfaction with his first performance on the fifth section. The scores reported to the low performance group on the fifth section were low enough so that a large number of response changes guaranteed a higher score. The scores reported to the high performance group on the fifth section were high enough so that a large number of response changes guaranteed a lower score.

Subjects who were told that they had done well changed fewer responses than subjects who were told that they had done poorly. This indicates that the subjects desired to do well regardless of expectancy. Of greater importance was a significant interaction effect supporting the hypothesis that subjects would strive to confirm their performance expectancies. Persons with low expectancies who had been told that they had done well changed more of their responses on the repeated performance than those who were told that they had done poorly. Persons with high expectancies who had been told that they had done well changed fewer responses on the repeated performance than those who were told that they had done poorly.

Lowin and Epstein (1965) hypothesized that the effect of expectancy found in earlier experiments might have been due to differences in memory or recall. They introduced the fifth section in the Aronson and Carlsmith task as a memory task. The subjects were required to remember which face they had selected on the last 20 cards. The high versus low expectancy treatment led to a significant difference in recall, a finding consistent with Brock et al. (1965). The authors interpreted this latter finding as evidence for the cognitive consistency explanation of the relationship between performance and expectancy.

Brock et al. (1965) carried out seven experiments to examine the effects of expected performance on actual performance. Again the basic design developed by Aronson and Carlsmith was used. A significant Expectancy X Performance interaction effect was found in experiments in which the scores were reported for the five sections. When feedback was provided after each trial, the Expectancy X Performance interaction was not significant.

Post-experimental interviews suggested that subjects were developing hypotheses under continuous feedback conditions which they were subsequently testing out. That the design did not intend for actual learning to take place is apparent. The high expectancy subjects received much support for their initial hypotheses while the low-expectancy subjects had to change hypotheses continually. There was a tendency in the data for low expectancy subjects to change more than high expectancy subjects.

Cottrell (1967) and Zajonc and Brickman (1969) used a reaction time task in an attempt to explore expectancy and feedback as independent variables. Both studies used a split-plot design to control for session to session variations in procedure. Cottrell (1967) had a 2x2x2 factorial design with expected performance, expectancy strength, and final performance (after expectancy had been established) as the independent variables. The expectancy treatment consisted of false feedback (85% success versus 25% success) in the expectancy formation phase. The strength of expectancy was the number of trials in the expectancy formation phase (either two or four blocks of 10 trials). The performance treatment was the score reported to the subjects in the final block of trials (either three or nine successes). An equipment failure was faked, and the subjects were required to repeat the performance block. No evidence was found for adjustments in task proficiency from the first to the second attempts at the performance block.

The procedure in the Zajonc and Brickman (1969) study involved six blocks of 10 reaction time trials. The first three blocks served to set a baseline for performance and to familiarize the subjects with the task. Half of the subjects stated expectancies prior to the fourth block and again prior to the fifth block. Feedback was provided during the fifth block by a "failure light" which indicated that performance had been too slow. The light flashed after 20% of the trials for the high feedback group, after 80% of the trials for the low feedback group, while the light did not flash at all for the no feedback group. For each feedback condition, subjects who had stated expectancies were divided into high and low expectancy groups by splitting them at the median of their stated expectancies.

Subjects who stated high expectancies prior to the fourth block already had performed at a higher level on the third block. The difference in change scores (between blocks three and four) between the high and low stated expectancies approached significance ($p < .10$). The change scores for both the high and low expectancy groups were significantly greater than for the no expectancy group. It seems that stating a performance expectancy might be sufficient to improve performance on a reaction time task in the absence of feedback.

Subjects who were provided feedback (block 5) showed significantly higher change scores than those who received no feedback. The difference in change scores due to success and failure feedback approached significance ($p < .10$). High expectancy subjects exhibited a tendency to improve more under success feedback than under failure feedback. However, subjects who had no performance expectancies or low performance expectancies improved more under failure feedback. A significant interaction was found between the effects of feedback and expectancy change upon performance. Subjects who resisted lowering their expectancies after failure on the fifth block showed more improvement on the sixth block than those who sharply lowered their expectancies. Success was not associated with the reverse effect.

Effect of Success or Failure on Expectancy

In all of the research previously cited, performance expectancies were created experimentally through manipulating success or failure feedback. Expectancy served as an independent variable rather than dependent variable. It was assumed that the differences between groups which were found to be significant were due to differences in expectancy which resulted from the experimental treatments.

Several of these studies have utilized expectancy measures as part of their design. Cottrell (1965) administered a post-experimental questionnaire asking his subjects to rate how well they would expect to do on a block of 10 additional trials. He used a modification of the Aronson and Carlsmith experimental design with four blocks of trials to create expectancy and one additional block to confirm or disconfirm the expectancy. Subjects in the high expectancy treatment (first four blocks) expected to do better on the post-experimental trial than subjects in the low expectancy treatment group. The final performance reported to the subjects (on the fifth block) did not seem to be incorporated into estimates of future performance.

In his later study, Cottrell (1967) again asked the subjects to estimate the number of successes that they would achieve on a post-experimental trial. Subjects who had been given reports of 85% success on the first few blocks expected to do better than subjects who had been given reports of 25% success. The strong expectancy treatments had a greater effect upon future success estimates than the weak expectancy treatments. The final performance feedback treatments also had a significant effect upon future success estimates.

The expectancy strength and performance feedback variables interacted in an interesting manner. In the weak expectancy conditions, discrepant final performance feedback had an effect upon future performance estimates. In the strong expectancy conditions, the subjects disregarded discrepant performance feedback when estimating future performance (as in Cottrell's 1965 study). The author concluded that discrepant feedback had a greater effect in the weak expectancy groups because it was less dissonant. Apparently, the more dissonant the feedback, the less likely it is to be accepted as a basis for estimating future performance.

The effects of feedback on performance in the Zajonc and Brickman (1969) experiment were similar to those found by Cottrell. Subjects raised their expectations after success and lowered them after failure.

Feather (1966) employed an experimental design which allowed him to examine the effects of experienced success or failure on expectations of success and subsequent performance. Instead of using false feedback, the subjects in Feather's experiment determined for themselves whether they passed or failed an item. The task involved solving a series of 15 anagrams (jumbled words). The independent variables in the study were high versus low expectation created by instructions given to the subjects prior to beginning the anagrams and initial success or failure on the first five items. Success was provided by making the first five items easy to solve, and failure was provided by making the first five items impossible to solve.

Feather looked at trial-by-trial changes in expectations of success in relation to the patterns of success and failure built into the experimental treatment. The subjects were required to give probability estimates prior to attempting each of the 15 anagrams. The overall mean probability estimate for subjects who experienced initial failure was significantly lower than that of subjects who experienced initial success on the first five trials. A highly significant interaction effect between initial experience and trials showed a tendency for probability estimates to increase over trials after initial failure and decrease after initial success. The absolute difference between probability estimates before and after the initial failure condition was significantly greater than the probability estimates before and after the initial success condition.

The hypothesis that initial success of failure would lead to differences in expectations is borne out in the Feather study. The data were analyzed further to see if differences in expectation would lead to differences in subsequent performance. Subjects who failed the first five anagrams were significantly less successful at the remaining 10 anagrams than subjects who succeeded at the first five anagrams.

These results were confirmed in another experiment by Feather (1968). Performance was found to be affected by initial success or failure. Performance correlated negatively with expectancy prior to trial one and correlated positively with expectancy prior to trial six (there were five initial treatment trials) for subjects who initially succeeded at the task. Performance correlated positively with expectancy prior to trial six for subjects who initially failed the task. Feather interpreted the data in terms of consistency theory. It was hypothesized that inconsistency may have motivating or energizing effects upon performance.

Hypotheses

Performance expectancies for a particular task seem to be affected by past performance on the same or similar tasks. Success and failure experiences have been shown to affect expectations of future performance. When the number of successes or failures experienced over experimental trials is increased, expectancies for future performance become more resistant to change.

Expectancies which have been developed over experimental trials have been shown to affect performance levels in approximately half of the studies reviewed. In these studies the subjects demonstrated performance changes consonant with the experimental hypotheses, even when this meant lowering their performances. The subjects in one study who resisted lowering their expectancies after failure subsequently showed more improvement than those who lowered their expectancies sharply. Not only the nature of feedback but also the subjects' reactions to feedback must be considered in the relationship between performance and expectancies.

The theoretical considerations and experimental results discussed above lead to the following questions of central importance to the present study:

1. Does expectancy influence performance over trials when the subjects are given accurate feedback about their performances?
2. Are the relationships between expectancy and performance found in previous research also operative in computer-assisted instructional programs?

3. Can expectancy be considered a motivational variable which affects the manner in which learners control their own learning with self-paced materials presented on computer terminals?
4. Does expectancy and false feedback on one task influence expectancy on a similar (transfer) task?

The present experiment was designed to answer these questions. It examined the role of expectancy as an independent variable in a learning task presented on a computer-assisted instructional system.

Unlike previous experiments the learner was presented an actual learning task. Previous experiments induced expectancies through the use of false feedback. In the present study subjects were provided actual feedback about their performances until all performance measures could be taken.

In order to provide actual feedback it was necessary to induce expectancies prior to the actual learning task and attempt to maintain these expectancies throughout the task. It was apparent from the previous literature that dissonant feedback would confound the effects of expectancy treatments. However, if subjects performed according to their expectations, actual performance feedback would not have been dissonant. If the subjects experienced dissonance due to performance feedback early in the task, cognitive consistency theory predicts that they would have changed their performances to meet their expectancies in order to alleviate the dissonance. Consequently, the more powerful the effect of expectancies, the less confounding would have been the effects of actual performance feedback.

Hypothesis 1. It was hypothesized that subjects with high expectancy would perform better and require less instruction on a computer-assisted instructional task than subjects with low expectancy.

It is possible for learners to perform at levels consistent with their expectancies by establishing specific performance criteria which they attempt to meet but not exceed. It was reasoned that if learners were allowed to control the shift from one instructional unit to the next, they would shift after reaching their expected performance levels.

Hypothesis 2. It was hypothesized that subjects with high expectancy would set higher performance criteria for themselves on a learner-controlled instructional task than would subjects with low expectancy.

Several of the studies reported above required the subjects to report expectancies for post-experimental tasks. These expectancies seemed to be affected by the expectancies induced for the experimental task as well as by the false feedback provided the subjects. The present study was designed to examine the relationships between expectancy and false feedback on one task and expectancy on a different task of equal difficulty (transfer task).

Hypothesis 3. It was hypothesized that subjects with high expectancy on the experimental task would have higher expectancy on a transfer task than would subjects with low expectancy on the experimental task. It further was hypothesized that subjects receiving success feedback on the initial task would have higher expectancy on a transfer task than would subjects receiving failure feedback on the initial task. The effects of expectancy and feedback were expected to interact so that expectancy on the transfer task would be highest for the confirmed high expectancy subjects and lowest for the confirmed low expectancy subjects.

The Experiment

This study was designed to explore the relationship between expectancy and performance in a computer-assisted instructional program in which the learner controls the pace at which he works and the amount of instructional material to which he is introduced. The use of a computer-assisted instructional system to present a self-paced learning task provided an opportunity to explore the effects of expectancy on a number of dependent variables. Also of interest was the effect of feedback on expectancy. The experimental design in this study employed the following procedures:

1. The learner was presented well-defined units of instruction which are hierarchical in nature, so that knowledge of previous units facilitates the learning of subsequent units; he was asked to state the number of examples that he expected to take and the number of test items he expected to answer correctly in each unit before shifting to the next unit.
2. The learner was tested after each example within a unit to determine whether or not he had mastered the essential concepts.
3. The learner was given the option after each example of either studying another example of the same rule in operation or moving on to an example of the next rule.
4. The learner was tested at the end of the instructional program to determine his ability to apply the concepts presented in the program.

5. The learner was given either success or failure feedback, supposedly based on his posttest scores.
6. The learner was required to answer a questionnaire measuring his general expectancy of success on a similar (transfer) task.

The procedures used to induce expectancies in the present study differ from those reported in previous research. In the present study, the subjects were required to state expectancies relative to a norm group. In the previous research expectancies were induced through false reports about performance. In these studies, early trials constituted the expectancy formation phases of the experiments. Since the present experiment was designed to provide accurate feedback about performance until all performance measures could be taken, the use of false feedback in an expectancy formation phase was not possible.

Diggory (1966) has proposed that expectancies which have been studied experimentally are based on the subject's concept of himself as an instrument to succeed at a particular task. Such self-concepts could be highly influenced by the subject's perceptions of the task. The perception of a task as being difficult might result in lower expectancies than the perception of a task as being easy. Requiring subjects to state expectancies relative to two false norm groups served to specify two distinctly different levels of difficulty.

In addition to experimentally induced differences in perceived difficulty level, the subjects in the high expectancy group were seen as differing from the subjects in the low expectancy group in task-specific self-concepts. It was reasoned that college students who were required to compare themselves to high school seniors would see themselves as quite adequate instruments to achieve or better the reported norm levels on a science task. However, it is doubtful that subjects who were comparing themselves to seniors in Geophysics at MIT would begin the same task with the perception of themselves as adequate instruments to equal or better the reported norm levels.

The use of false norms to create expectancies provided an opportunity to see if expectancies could be maintained over trials in which the subjects obtained actual performance feedback. It seemed that if expectancy is indeed a variable of concern in the educational encounter, we would expect the performance of subjects to confirm their expectancies rather than disconfirm them. Hence, the more powerful the expectancy treatment, the less confounding would be the subjects' perceived performance (based upon actual feedback).

According to cognitive consistency theory, actual performance feedback actually might assure a greater discrepancy between high and low expectancy groups. Subjects who expect to do well but do poorly would be motivated to perform better. Subjects who expected to perform poorly but performed well also would be motivated to perform more in line with their expectancies.

Dependent Variables

The dependent variables in this study were as follows:

1. numbers of examples presented on the computer terminal;

2. numbers of test items answered correctly on each rule before shifting to the next rule;
3. posttest scores;
4. expectancy scores on the transfer task.

The number of examples is an index of the amount of instructional material studied by the learner. The number of test items answered correctly on each rule before shifting indicates the performance criterion that the learner established for himself. The posttest score served as an indication of level of concept attainment.

Experimental Task and Materials

The experimental learning task used in this study is an imaginary science program called the Science of Xenograde Systems. The version used in the present study was developed by Merrill (1964) and was adapted for presentation on the IBM 1500/1800 computer-assisted instruction system by Paul Merrill and William Olivier according to an instructional design model developed by Bunderson (1969). The learner-control procedure of display presentation was developed by the author and named Senog to distinguish it from Xenog, the learner non-control procedure. The following description of the Xenograde system is provided by Merrill (1970):

> In the current version of the Science, a Xenograde System consists of a nucleus with an orbiting satellite. The satellite is composed of small particles called alphons which may also reside in the nucleus. Under certain conditions, a satellite may collide with the nucleus. When such a collision occurs, a "blip" is said to have occurred, and the satellite may exchange alphons with the nucleus. The subject matter of the Science deals with the principles or the rules by which the activity of satellites and alphons may be predicted [p. 16].

The Xenograde task is presented in 10 units, each designed to teach one rule. The 10 rules are hierarchical so that knowledge of previous rules is helpful in learning any one rule. The 10 rules do not represent the minimum number of statements necessary to define the "laws" of a Xenograde system. Instead, the rules are modules corresponding to 10 steps in an algorithm leading to a terminal objective. This objective requires "... that Ss predict and record the state of the alphons and satellite of a Xenograde system at successive time intervals, given the initial state of the system at time zero (Merrill, 1970, p. 17)."

Each rule can be considered an instructional unit, and each is taught through the same procedure. The subject is presented a partial Xenograde table on a cathode-ray tube (CRT) as an example of the rule in operation. The table presents data illustrating the activity and relationships between the nucleus, satellite, and alphons at several points in time. After studying the example for as long as he wishes, the subject presses a control button on the terminal which advances a series of three test items consisting of incomplete Xenograde tables. These tables can be completed correctly if the subject has correctly inferred the rule. The subject types his response on the keyboard of a computer terminal.

After typing his response, the subject is informed of the number of test items answered correctly. In the learner-control procedure (Senog) employed in this study, the subject then is allowed either to choose another example of the same rule or to progress on to the next rule. In the non-learner-control procedure (Xenog) the learner is shifted from one rule to the next when he answers two of the three test questions correctly after any example of a rule.

A printed instruction booklet was provided for each subject. It contains a description of the Xenograde program and instructions on reading Xenograde tables. The first paragraph is fictitious and is part of the experimental treatments to be described later. The remaining portion is an accurate description of the program.

Method

Subjects. Eighty undergraduate college students from an introductory psychology course (Psychology 301) at The University of Texas at Austin participated in this study. They were required to participate in experiments totalling four hours in duration in order to receive course credit. They signed up to participate in this experiment at a particular time without having knowledge of the nature of the experiment. They received no financial compensation for participating in this study.

Measuring instruments. The computer-assisted instructional system recorded the stated expectancies, number of examples, and number of test items answered correctly. The posttest consisted of 18 incomplete Xenograde tables in which the subjects filled in the alphon count in the nucleus, blip time, satellite distance, and alphon count in the satellite. This test was developed and refined in the Computer-Assisted Instruction Laboratory at The University of Texas in order to assess how well the students meet the terminal objective stated earlier (Merrill, 1970). Allowing one point credit for each bit of data, the highest possible score is 62.

The expectancy measure on the transfer task is a Likert Scale developed by the author. It was designed to measure general expectancy of success on the transfer task rather than requiring subjects to state the specific types of expectancies required in the Xenograde task.

Procedures. The subjects were assigned randomly to one of four groups: high expectancy--success, high expectancy--failure, low expectancy--success, and low expectancy--failure. The subjects were told that the purpose of the study was to obtain their evaluation of a science program. The first paragraph in the instruction booklet given to the high expectancy subjects reads as follows:

> You have been asked to help evaluate a science program which has been developed to help high school seniors conceptualize science systems. It is comprised of instructional tasks, like Senog, which can be completed at one sitting.

In contrast, the low expectancy subjects were given the following description of the task:

> You have been asked to help evaluate a science program which has been developed for the Department of Geophysics at MIT. It was designed to teach senior seminar students in the physical sciences rules for inference, prediction, the formulation and testing of mathematical hypotheses, controlling and manipulating variables, interpreting scientific data, and formulating models. The program has been developed so that it can be taught on a computer terminal. It is comprised of instructional tasks, like Senog, which can be completed at one sitting.

Before each rule, the high expectancy subjects were presented a display on the CRT which gave them the average number of examples required by high school students for that rule and the average number of test questions (of the three possible) that high school students answered correctly before shifting to the next rule. The averages reported as high school averages were actually those obtained by Merrill (1970) for undergraduates at The University of Texas adjusted by the author for the learner-control procedure.

The low expectancy subjects were given similar displays before each rule, but the same averages reported to the high expectancy group as high school averages were reported to the low expectancy group as averages for seniors at MIT.

All subjects were required to estimate their expectancies regarding the numbers of examples to be used and the number of test questions to be answered correctly before shifting. The expectancy treatments then consisted of falsely reporting the typical performance of a group before each rule and requiring the subjects to state expectancies of performance relative to the group.

Subjects were administered the Xenograde (Senog) task on the CRT, including the 10 expectancy displays. Upon completing the task, they were given a posttest to assess actual learning on the Xenograde task. The Xenograde task had been described as a Level I task in a series of science programs. Subjects in the success group were told that they were ready for a Level II task, and that this task should be comparable in difficulty to the Level I task at the beginning of the program. Subjects in the failure group were told that their performance indicated that they must complete another Level I task before they could begin a Level II task.

Then all subjects were given a brief description of Senex, another task in the series. Following this, they were administered the expectancy scale for Senex. Subjects then were told about the deception in the experiment and the need for secrecy.

One of the subjects in the low expectancy group failed to complete the expectancy questionnaire. He and one subject from each of the other three groups were excluded from the analysis of variance of expectancy scores on the transfer task, yielding 19 subjects in each group. He also was excluded from the correlations computed on the low expectancy group.

Results

The expectancy measures served as a check on the experimental treatments. These measures are an indication of the potency of the experimental treatments. The means, standard deviations, and analyses of variances of the expectancy measures are presented in Tables 1 through 4. The high expectancy group expected to take fewer examples ($p < .05$) than did the low expectancy group. The expected number of examples varied between rules yielding a highly significant main effect for rules, but the Rule X Group interaction was not significant. In the analysis of variance of the expected number of test items to be answered correctly before shifting to the next rule, the groups main effect and the Rule X Group interaction were not significant. The rules main effect was found to be highly significant. The significant main effects for rules found on both expectancy measures reflect differences in the norms reported for the various rules. It was known before beginning the experiment that the rules were not of equal difficulty. Consequently the norms reported for each rule corresponded to the norms obtained by Merrill (1970).

An examination of the differences between groups in expectancies for each rule revealed a trend over rules. The differences between groups in expectancies are greater in the first few rules than they are in the

Table 1

Means and Standard Deviations of Expected Numbers of Examples

	High Expectancy		Low Expectancy	
	M	SD	M	SD
Rule 1	2.85	.86	3.50	1.06
Rule 2	2.30	.94	2.57	.98
Rule 3	2.02	1.12	2.32	1.11
Rule 4	1.82	1.13	2.25	1.21
Rule 5	1.77	.83	2.15	1.10
Rule 6	1.75	.84	2.20	1.06
Rule 7	1.87	.91	2.25	1.08
Rule 8	1.82	.98	2.05	1.13
Rule 9	1.85	.92	2.25	1.10
Rule 10	1.60	.90	1.97	1.07
Total	20.00	7.51	22.50	9.13

Table 2

Analysis of Variance of Expected Numbers of Examples

Source	MS	df	F
Groups	28.88	1	4.34*
Error (groups)	6.66	78	
Rules	12.84	9	30.18**
Rules X Groups	.34	9	<1.00
Error (rules)	.42	702	

*p <.05
**p <.001

Table 3

Means and Standard Deviations of Expected Numbers of Test Items Answered Correctly Before Shifting

	High Expectancy		Low Expectancy	
	M	SD	M	SD
Rule 1	2.30	.61	1.95	.71
Rule 2	2.65	.70	2.42	.71
Rule 3	2.65	.62	2.70	.72
Rule 4	2.55	.78	2.70	.56
Rule 5	2.65	.66	2.65	.70
Rule 6	2.70	.56	2.80	.40
Rule 7	2.62	.70	2.72	.55
Rule 8	2.65	.58	2.62	.67
Rule 9	2.60	.63	2.70	.61
Rule 10	2.57	.71	2.75	.63
Total	26.02	4.32	26.00	3.83

Table 4

Analysis of Variance of Expected Numbers of Test Items Answered Correctly Before Shifting

Source	MS	df	F
Groups	.12	1	<1.00
Error (groups)	1.70	78	
Rules	2.42	9	8.56*
Rules X Groups	.46	9	1.62
Error (rules)	.28	702	

*p < .001

remaining rules. The difference between expected numbers of examples was significant at the .025 level on the first rule, .05 level on the second rule, and .10 level on most of the other rules. The expected numbers of test questions to be answered correctly before shifting was significant at the .05 level on the first rule but did not approach significance on any of the other rules. These differences could be attributed to the effect of feedback over rules. However, these differences between rules were not statistically significant.

Dependent variables. In the first hypothesis, subjects with high expectancy were expected to perform higher and require less instruction on a computer-assisted instructional task than subjects with low expectancy. The means, standard deviations, and analyses of variance of the performance and instructional measures for the experimental groups are presented in Tables 5, 6, and 9. No significant differences were found between the high and low expectancy groups on the performance variable (posttest scores) or the amount of instruction (number of examples). Consequently, the first hypothesis was rejected.

In the second hypothesis, subjects with high expectancy were expected to set higher performance criteria for themselves on a learner-controlled instructional task than subjects with low expectancy. The means and standard deviations and an analysis of variance of the numbers of test items answered correctly before shifting by the experimental groups are presented in Tables 7 and 8. As no significant differences were found between the high and low expectancy groups, the second hypothesis was rejected.

Table 5

Means and Standard Deviations of Numbers of Examples

	High Expectancy		Low Expectancy	
	M	SD	M	SD
Rule 1	2.35	1.07	2.27	.99
Rule 2	2.02	1.27	2.27	1.08
Rule 3	1.60	.98	1.72	1.24
Rule 4	1.57	.71	1.72	.96
Rule 5	1.60	1.08	1.50	.85
Rule 6	2.00	1.26	1.57	.75
Rule 7	1.65	1.05	1.40	.81
Rule 8	1.30	.82	1.07	.27
Rule 9	1.72	1.10	1.92	1.14
Rule 10	1.37	.81	1.47	.75
Total	17.22	6.70	17.17	5.55

Table 6

Analysis of Variance of Numbers of Examples

Source	MS	df	F
Groups	.2812	1	<1.00
Error (groups)	3.10	79	
Rules	9.17	9	12.94*
Rules X Groups	1.00	9	1.41
Error (rules)	.71	702	

*$p < .001$

Table 7

Means and Standard Deviations of Numbers of Test Items Answered Correctly Before Shifting

	High Expectancy		Low Expectancy	
	M	SD	M	SD
Rule 1	2.75	.70	2.80	.61
Rule 2	2.57	1.00	2.70	.91
Rule 3	2.55	.93	2.45	1.04
Rule 4	2.85	.58	2.67	.86
Rule 5	2.82	.45	2.80	.46
Rule 6	2.52	.99	2.70	.69
Rule 7	2.62	.77	2.65	.80
Rule 8	2.77	.62	2.80	.61
Rule 9	2.47	1.01	2.62	.90
Rule 10	2.97	.16	3.00	.00
Total	26.80	4.62	27.30	4.74

Table 8

Analysis of Variance of Numbers of Test Items Answered Correctly Before Shifting

Source	MS	df	F
Groups	.28	1	<1.00
Error (groups)	2.08	78	
Rules	1.69	9	4.14*
Rules X Groups	.26	9	<1.00
Error (rules)	.41	702	

*p < .001

Table 9

Means, Standard Deviations, and t Test of Difference Between Means on Posttest Scores

	High Expectancy M	High Expectancy SD	Low Expectancy M	Low Expectancy SD	t
Posttest scores	51.20	13.44	52.25	12.26	.26

Table 10

Means and Standard Deviations of Expectancy Scores on the Transfer Task

	High Expectancy M	High Expectancy SD	Low Expectancy M	Low Expectancy SD
Success Feedback	37.10	5.51	39.05	10.60
Failure Feedback	41.84	7.77	39.79	7.76

Table 11

Analysis of Variance of Expectancy Scores on the Transfer Task

Source	MS	df	F
Expectancy	.05	1	<1.00
Feedback	142.31	1	2.16
Expectancy X Feedback	76.00	1	1.15
Error	65.78	72	

In the third hypothesis, subjects with high expectancy on the experimental task were expected to have higher expectancy on a transfer task than were subjects with low expectancy on the experimental task. It was hypothesized further that subjects receiving success feedback on the experimental task would have higher expectancy on the transfer task than would subjects receiving failure feedback on the experimental task. The effects of expectancy and feedback were expected to interact so that expectancy on the transfer task would be highest for the confirmed high expectancy subjects and lowest for the confirmed low expectancy subjects. The means, standard deviations, and an analysis of variance of expectancy scores on the transfer task for the experimental groups are presented in Tables 10 and 11. The analysis of variance produced no significant main or interaction effects. Consequently, the third hypothesis was rejected.

Feedback from the test items was found to have no significant effect on the differences between groups over rules. If the differences between groups changed significantly over rules, the Rule X Group interactions on the dependent variables would have been significant. The probability levels for differences between groups on the dependent variables were much the same on the first rules as on the middle and last rules.

In order to examine the effects of dissonant feedback, the subjects were divided into three groups. The subjects in the high expectancy group were coded as experiencing dissonance when they took more examples than they had expected. The subjects in the low expectancy group were coded as experiencing dissonance when they took fewer examples than they had expected. All other subjects were coded as not experiencing dissonance.

Subjects in the high expectancy group who took fewer examples than they had expected, and those in the low expectancy group who took more examples than they had expected, theoretically were not in dissonance. Consequently they were placed in the no-dissonance group. An examination revealed that these subjects did not differ on the variables of concern from the subjects who had performed according to their expectations.

The effects of dissonant feedback were represented most clearly in the changes in expectancies and performance from rule one to rule two. Any trend found to be significant on the other rules also was found to be operative in the changes from rule one to rule two.

The number of subjects experiencing dissonance on rule one who changed their expected and actual numbers of examples on rule two are presented in Table 12. A comparison of the numbers of subjects in the dissonance-low expectancy group with those in the no-dissonance group who expected fewer or the same number of examples on rule two resulted in a significant chi-square. Subjects in the dissonance-low expectancy group had a significantly greater tendency to expect to take fewer examples on rule two. The same significantly different changes in expected numbers of examples was found from rule six to rule seven and from rule eight to rule nine. While dissonance seemed to be related to changes in expectancy in subjects who performed better than they expected, dissonance was not related to a significant difference in performance changes in the same subjects.

A comparison of the dissonance-high expectancy group with the no-dissonance group in number who took fewer or the same numbers of examples on rule two than they had taken on rule one yielded a chi-square which approached significance ($P < .10$). Subjects in the dissonance-high expectancy group had a greater tendency to take fewer examples on rule two than did the no-dissonance subjects. The same trend was noted on every rule, with the chi-squares reaching the significance level ($p < .05$) on rules four, five, six, and eight.

The number of subjects experiencing dissonance on rule one who changed their expected and actual numbers of test items answered correctly before shifting on rule two are presented in Table 13. A comparison of the dissonance-high expectancy group with the no-dissonance group in numbers who expected to answer fewer or the same number of test items correctly before shifting on rule two than they had expected on rule one yielded a significant chi-square. Also, a comparison of the dissonance-low expectancy group with the no-dissonance group in numbers who expected to answer more or the same number of test items correctly before shifting on rule two than they had expected on rule one yielded a significant chi-square. Subjects who performed poorer than they had expected on rule one had a greater tendency to raise their expectancies on rule two. Dissonance in performance and feedback on rule one seemed to have a greater effect on rule two upon expectancies than upon performance. Few subjects were coded as being in dissonance on rules two through 10 due to the number of test items answered correctly before shifting.

Table 12

Numbers of Subjects Experiencing Dissonance on Rule One who Changed their Expected and Actual Numbers of Examples on Rule Two

Groups	Change in Expected Numbers of Examples				Change in Numbers of Examples			
	Fewer	Same	More	Total	Fewer	Same	More	Total
Dissonance-high expectancy	0	5	2	7	5	1	1	7
No dissonance	18	33	6	57	21	29	7	57
Dissonance-low expectancy	13	3	0	16	7	6	3	16
Total	31	41	8	80	33	36	11	80

Table 13

Numbers of Subjects Experiencing Dissonance on Rule One who Changed their Expected and Actual Numbers of Test Items Answered Correctly Before Shifting on Rule Two

Groups	Change in Expected No. of Test Items Correct				Change in Numbers of Test Items Correct			
	Fewer	Same	More	Total	Fewer	Same	More	Total
Dissonance-high expectancy	4	2	0	6	1	3	2	6
No dissonance	5	45	8	58	9	48	1	58
Dissonance-low expectancy	0	5	11	16	1	15	0	16
Total	9	52	19	80	11	66	3	80

Discussion

In the present study there were several ways in which expectancies could have affected performance. Expectancies could have had an energizing effect upon performance as was hypothesized by Feather (1968). The subjects, then, could have avoided dissonance by performing as they expected to perform. Expectancies also could have caused dissonance in subjects who did not perform as they expected to perform on the early rules. Such subjects then might have been expected to perform closer to their expected performance levels on later rules.

Several expectancy measures were taken in the present study. The expected numbers of examples before each rule can be interpreted as the expected difficulty level. The expected numbers of test items to be answered correctly before shifting can be interpreted as the performance criteria the subjects expected to use in shifting from one rule to the next. While there was a significant difference between the numbers of examples that the two expectancy groups expected to take, the treatments were not powerful enough to be reflected in significant differences on the dependent variables.

Expectancies in the present study did not have significant energizing effects. The learner control procedure in this study made it possible for the subjects to control the performance criteria for shifting from one rule to the next. It was hypothesized that the low expectancy subjects would shift at lower performance levels than would the high expectancy subjects, thereby demonstrating the energizing effect of expectancies. The lack of significant experimental results led to a rejection of this hypothesis.

The success-failure treatment in this study was found to have no significant effect upon the expectancies stated for the transfer task. The subjects seemed to base their expectancies more upon their actual performance than upon the false feedback that constituted the success-failure treatments.

Effects of Actual Performance Feedback

The purpose of this study was to examine the relationships between expectancy and performance in an actual instructional task. Subjects in previous studies had not received accurate feedback about performances on actual instructional tasks. It was expected that the effects of the expectancy treatments in the present study would change over trials as the subjects received feedback on the test items.

However, the feedback from the test items was not found to affect differences between the treatment groups on the dependent variables. The only significant Rule X Group interaction could not be explained in any discernible trend. While the trend over rules was such that the probabilities of obtaining the observed differences between groups in expected numbers of examples increased after the first few rules, the trend was not significant. Had the treatments been more powerful, the effects of feedback may have been more pronounced.

Dissonant feedback was found to have one of the effects predicted by cognitive consistency theory. Subjects who took more examples than they had expected to take had a greater tendency to take fewer examples on the next rule. However, the reverse was not found to be true of subjects who took fewer examples than they had expected. They did not have a greater tendency to take more examples on the next rule as would be predicted by cognitive consistency theory. The significant differences in changes in performance might have been due to need for achievement, or a number of other motivational variables.

Dissonant feedback seemed to have a more powerful effect upon expectancy changes than it did upon performance changes. Subjects who took fewer examples than they expected changed their expectancies for the next rule rather than their performances. This is in contrast to the Aronson and Carlsmith (1962) study in which the authors inferred that subjects who performed better than they expected attempted to perform more poorly when given a chance to change their performances. The present study indicates that dissonant feedback in an actual instructional task does not have the effects predicted solely by cognitive consistency theory. Dissonant performance which was lower than expected seemed to result in changes in performance while performance which was better than expected seemed to result in changes in expectancies.

The subjects in the present study set certain performance criteria for shifting from one rule to the next before each rule. Those whose performances were coded as dissonant on rule one had a greater tendency to change their expectancies on rule two in the direction of their performances on rule one. Subjects who had shifted before they had expected on rule one lowered their expected criteria for shifting on rule two, while those who answered more test items correctly before they shifted on rule one raised their expected criteria on rule two. Dissonant feedback led to changes in expectancies, but not performance.

Contributions of the Study

The experimental design employed in this study had several advantages over previous designs for inferring the relationships between expectancies and performance. The use of a computer-assisted instructional system minimized the subject's interpersonal interaction during the experiment. This served to control the possible confounding effects of experimenter demands mentioned in the Aronson and Carlsmith (1962) study. It also served to control the effects upon self-concept of the perceptions of "significant others" discussed by Coopersmith (1967).

Differences in performance could have resulted from the energizing effects (Feather, 1968) of expectancy rather than the dissonance effect used in most of the studies reviewed. The subjects were given the opportunity to avoid dissonance by performing according to their expectancies. The measurement of expectancy for a transfer task served to examine the extent to which performance on one task was related to the development of expectancies for a similar task.

The use of the Xenograde task provided an actual instructional program in the design. Previous studies had not used actual instructional programs. The results of the present study can be generalized to the educational encounter.

In previous studies, the subjects were not provided with actual performance feedback, except in cases in which they failed on impossible tasks. The present study examined the effects of actual performance feedback upon both performance and expectancies.

While other studies have failed to demonstrate that expectancies exert powerful effects upon performance, they have not provided actual counter-argumentative data. The present study has demonstrated that dissonant performance is more likely to lead to changes in expectancies than to changes in performance.

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